

Space-based Gravitational-wave Observatory (SGO)

Code 663

Prototype Telescope Statement of Work (SOW)

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TABLE OF CONTENTS

	<u>Page</u>
1.0 INTRODUCTION.....	3
2.0 REFERENCE DOCUMENTS.....	3
3.0 WORK TO BE PERFORMED	3
3.1 SCOPE.....	3
3.2 HARDWARE CONTENT	4
3.2.1 Telescope Physical Description	4
3.2.2 Telescope Design Description	4
3.2.3 Meetings and Reports	4
3.2.4 Systems Engineering	4
3.3 TEST RESULTS	5
3.3.1 Test results for components	5
3.3.2 Test results for assembled telescope	5
3.3.3 Validation modeling results for pathlength stability and stray light	5
4.0 PERIOD OF PERFORMANCE	5
5.0 END OF CONTRACT DELIVERABLES	5

1.0 Introduction

This Statement of Work specifies what is to be delivered by the contractor in support of the SGO (Space-based Gravitational-wave Observatory) Telescope development work.

The purpose of this procurement is to acquire a prototype telescope to check if the requirements and specifications developed for the telescope are sufficient to construct a working model that meets the requirements, or if there are missing or improperly specified requirements. It is anticipated that there will be at least one other iteration of the telescope design before an engineering design unit (EDU) is constructed. The activity is intended to build and deliver a feasible prototype telescope that meets the preliminary science requirements as outlined in Attachment A, and functions according to specifications in the critical thermal, optical, mechanical and dynamic environments that drive the SGO telescope design.

2.0 Reference Documents

The following document relating to this study is attached: Attachment A: Prototype Telescope requirements. A strawman optical design is included as a starting point.

3.0 Work to be performed

The contractor shall design and build a low cost prototype telescope that meets the requirements set out in Attachment A: Prototype Telescope Requirements Document. The contractor shall perform only those tests required to deliver a working and properly aligned telescope. Thermal cycling, shock, vibration, or any other testing normally performed on flight units is not required.

Materials choices should take into consideration that the ultimate goal is to work at -70 C in space. For the purposes of this prototype, laboratory testing, at least initially, will be confined to room temperature. Please see Section 3.2 for a description of the required test results.

3.1 Scope

- 1) Identify an optical and mechanical design that meets the requirements
Including
 - a. Mass and volume
 - b. Mechanisms
 - c. Optical mounting
 - d. Dimensional stability
 - e. Materials
- 2) Verify by analysis compliance with requirements (13) pathlength stability and (14) stray light (See Appendix A)
- 3) Construct, test, and deliver the prototype

- 4) Testing is limited to wavefront error (WFE) and any other alignment tests needed to verify optical operation at room temperature

3.2 Hardware Content

At a minimum the contractor shall address and provide information on the following to a degree of accuracy that is commensurate with a prototype design:

3.2.1 Telescope Physical Description

- Provide figures of the configuration showing physical layout of the primary components.
- Provide a detailed master equipment list for design.

3.2.2 Telescope Design Description

- Provide descriptions, including drawings and 3D models of the “as built” mechanical structure, optical design and any mechanisms used. Materials and mechanisms must have flight heritage or a clear path to flight qualification in the sense that there is nothing about the choices that precludes flight, but no work should be done to actually flight qualify anything.

3.2.3 Meetings and Reports

- Initial kick-off meeting to discuss details and answer questions
- Monthly progress meetings via telecon
- Telecons/consultations as needed to address issues/concerns/questions.
- Final report to be delivered to GSFC at the conclusion of the study.

3.2.4 Systems Engineering

3.2.4.1 Design

- Provide a design/model of the telescope
 - Prescription
 - Surface figures for each surface
 - Element spacing
 - mirror composition and coatings
 - Performance data
 - End-to-end wavefront
 - Field of view expected
 - Seidel aberrations
 - Throughput
 - Any manufacturability concerns
 - Surface shape
 - Figure tolerance
 - Required rms surface roughness
 - Alignment and/or shop tolerances required to achieve performance
 - Cleanliness requirements

3.2.4.2 Validation

- Provide validation by analysis of the design and performance.
- Provide and substantiate error budgets for all relevant portions of the telescope, including mechanical, optical and thermal.

3.3 Test Results

Provide “as built” test results for comparison against the validation model.

3.3.1 Test results for components

- Provide “as built” test results for the individual components
 - WFE
 - Surface roughness
 - Figure errors

3.3.2 Test results for assembled telescope

- System WFE at Room temperature

3.3.3 Validation modeling results for pathlength stability and stray light

- Copy of the model and results

4.0 Period of Performance

The expectation is that a fully assembled and tested telescope should be delivered approximately 10 months from the start of the contract. A shorter time is preferred, and 12 months is the upper bound.

5.0 End of Contract Deliverables

- 1) Completed Telescope hardware
- 2) Optical alignment and WFE test data and results
- 3) Optical, mechanical, and thermal design models and analysis result(s) showing spec compliance
- 4) CAD model and any drawings generated as a normal part of manufacturing. It is not necessary to have flight-level QA-type reviews and supporting documentation.